ABANDONED AND INACTIVE MINE (AIM) LANDS INVENTORY FOR THE USDA – FOREST SERVICE, REGION 9 MONONGAHELA AND WAYNE NATIONAL FORESTS

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ABSTRACT

According to the Abandoned Mine Land Inventory System assembled by the Office of Surface Mining (OSM), there are over 575,000 acres of abandoned mine land in the eastern United States, some of these abandoned mines are encountered within National Forests. As a result of the need to better manage public land, the Forest Service was tasked with identifying features associated with abandoned mines. The inventories developed would enable the Forest Service to better understand and improve watersheds impacted by acid mine drainage. In addition, inventories would be a useful component for various resource applications. Region 9 of the Forest Service and the United States Army Corps of Engineers (USACE)-Huntington District joined efforts and developed a format and methodology to perform abandoned mine inventories at the Monongahela Forest and Wayne National Forest (WNF). Corps personnel implemented the methodology and completed the abandoned and inactive mine (AIM) land inventory for the Monongahela Forest, the Ironton District of the WNF, and for three additional watersheds within the Athens District of the WNF. Fuller, Mossbarger, Scott, and May Engineers, Inc. (FMSM) performed inventory work in the Athens District through the Corps of Engineers' indefinite delivery contract. Successful partnering between the Forest Service, the Corps of Engineers, and FMSM has culminated in the completion of a highly versatile inventory with application and value for many environmental stewardship agencies and organizations throughout the region. This highly successful collaborative effort is expected to continue as the Forest Service plans to extend the inventory into additional basins as funding becomes available.

INTRODUCTION

The Monongahela and Wayne National Forests are part of the Eastern Region of the Forest Service, also known as Region 9. Both National Forests are situated within the Appalachian Coal Region, which extends from northern Pennsylvania to northwestern Alabama. The Monongahela National Forest (MNF) is comprised of 909,000 acres in ten counties along eastern West Virginia (see Figure 1). The Wayne National Forest (WNF) is divided into three Districts — Athens, Marietta and Ironton — which extend over 232,900 acres in southeastern Ohio (see Figure 2).

Figure 1. Monongahela National Forest Boundary

As a result of the abundance of thick seam coal deposits, large areas of each park have been subjected to extensive surface and underground coal mining since the 1800's. Exploitation of these resources created numerous adverse impacts associated with coal mines operating prior to the enactment of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Modern signatures of these earlier impacts include subsidence failure of the overburden, mine entrances left open, abandoned unstable highwalls, piles of toxic gob spoil material, and the release of acid mine drainage (AMD) that contaminates the surface streams. Although most of the disturbed land is now covered with relatively mature vegetation, remnants of the mining such as voids created near the surface by ground subsidence, unstable highwalls, open portals and acid mine drainage pose hazards to public safety and environmental health.

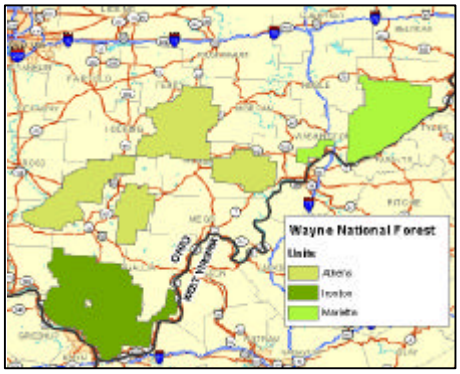


Figure 2. Wayne National Forest Boundary

PARTNERSHIPS AND RECLAMATION MEASURES

For several years personnel from both parks have developed and implemented projects to reclaim the land disturbed by previous mining work. Some of these projects are funded and/or implemented in partnership with other state and federal agencies, and private entities. For example, in the case of the WNF, the Monday Creek Restoration Project is a reclamation effort involving American Electric Power, Hocking College, the Office of Surface Mining, Ohio EPA (OEPA), Ohio Department of Natural Resources (ODNR), Ohio University, West Virginia University, Rural Action, the Forest Service, and the U.S. Army Corps of Engineers. OSM and EPA have recognized this effort as a model of partnering for improvement of the environment.

The measures to reclaim abandoned mine lands include treating acid mine drainage, restoring drainage channels, filling in subsidence depressions and surface voids, grading, soil

capping and re-vegetating gob piles, and installing bat gates at mine openings or closing them. A description of current individual projects performed at each park can be reviewed at their respective web sites, www.fs.fed.us/r9/mnf/ and www.fs.fed.us/r9/wayne/.

INVENTORY WORK

The significant extent of the disturbance caused by prior coal mining resulting in thousands of hazardous abandoned mine land (AML) features scattered throughout both Forests prompted Region 9 of the Forest Service to develop an inventory of the associated impacts. Initial inventory methods implemented in Region 3 of the Forest Service were first used as a basis to plan inventory work at the Monongahela National Forest. The MNF represented by Linda Tracy and the United States Army Corps of Engineers (USACE), Huntington District represented by Steve Brewster and Steve Spagna, all co-authors of this paper, teamed up and developed an inventory method, which included developing a data dictionary to organize and facilitate the fieldwork. A Global Positioning System (GPS) was used in the field to record the exact location of each AML feature. In addition to selected laboratory testing, water quality field parameters were obtained for streams, seeps and ponds using portable equipment. This initial inventory effort in Region 9 of the Forest Service was completed in 1998.

The USACE-Huntington District partnered again with the WNF to inventory abandoned mine lands in the Ironton District of the WNF. The results of this work are reported in the Ironton District Abandoned Mine Lands Inventory, dated June 2000, which can be viewed on the Ironton District web site at www.fs.fed.us/r9/wayne/.

In 2000, the WNF prepared a Statement of Work for Athens Ranger District Abandoned and Inactive Mines (AIM) Inventory, which the USACE-Huntington District then used as a basis to contract Fuller, Mossbarger, Scott and May Engineers (FMSM) to inventory AIM land in the WNF Athens District. Phase 1 of the work consisted of inventorying 4,000 acres within the boundaries of the Athens District, in the general vicinity of Nelsonville, Ohio. This initial inventory was focused within the Monday Creek watershed. The USACE-Huntington District provided mapping which delineated Forest Service property and boundaries for the 35 search areas, a data dictionary depicting data collection requirements for each search area, and assisted in the initial fieldwork to train the teams deployed by FMSM. The Forest Service prioritized areas for inventory, based on ODNR-Division of Mineral Resources underground mine maps and known underground mine locations (see Figure 3).

Figure 3. Portion of USGS Topographic Quadrangle Showing Location of Mine Portals Encountered Within the Big Four Search Area

The work order for Phase 1 was issued November 2000 and required that FMSM provide four two-person teams, each led by an experienced geologist, to perform discovery and field inventory work by walking up drains (hollows) and along hillside elevation contours of known coal seams and benches in specified areas. When a mine feature was found, its exact location was

recorded using a GPS Unit. Because GPS reception is limited by topography and forest cover, field data was collected during the fall and winter months when GPS signal interference from tree canopies is reduced. Where GPS reception was limited, locations of mine features were carefully placed onto US Geological Survey quadrangle maps. UTM coordinates were scaled off the maps in these situations. GPS-obtained location information was differentially corrected by downloading base station data from an Internet web site.

Additional information about each mine feature was then recorded in the data logger of the GPS unit. The data logger was programmed in advance of the fieldwork using the data dictionary provided by the USACE-Huntington District. The data dictionary defined nine (9) types of AIM features to be inventoried, such as portals, ponds, subsidence features, etc. The dictionary also included several descriptive parameters for each type of feature. For example, when a portal was encountered within a search area, the dictionary dictated that pertinent information such as coordinate locations, dimensions, distance from nearest improvement, evidence of visitation, water discharge, water quality testing and dangers to public be recorded.

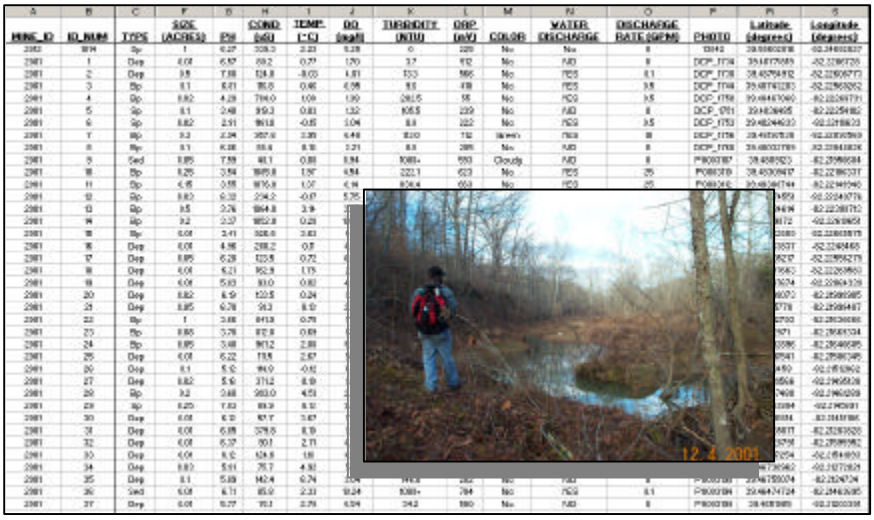


Figure 4. Example of Field Data Collected of Ponds Identified Within One Search Area and a Digital Photograph of One of the Ponds

Any pond, seep or stream encountered along the selected drains was subjected to water quality testing using a portable instrument. This portable unit was capable of measuring multiple parameters simultaneously, including temperature, pH, conductivity, dissolved oxygen, oxygen reduction potential and turbidity. The water quality testing results were also stored directly into the data collector of the GPS unit. A digital picture of each feature was taken and exported into the respective data file.

At the end of each day, the field teams transferred the information stored in the GPS data collector to a laptop computer, where it was stored in a spreadsheet (see Figure 4). Having all the information in a spreadsheet allowed the teams to perform quality control reviews and check for errors. Back in the office, the spreadsheet information was assembled in ArcView export format to create topographic map plots of the different search areas. Symbols and identification numbers were used to show each feature on the map plots (see Figure 3). The basic delivery to the USACE-Huntington District and the Forest Service included hard and electronic copies of the spreadsheets containing the field data and the search area plots.

Phase 2 of the work added 28,400 acres of federal land to the scope of work. Subsequent modifications to Phase 2 added to the inventory work 3,300 acres of private property within the Monday Creek watershed, and 2,800 acres located in the Ironton District. The statement of work

also required that a database be created with the entire inventory data, and merging it with an existing database of the Ironton District. Phases 1 and 2 of the work were completed in April 2001.

In the 2001-2002 winter season, the USACE-Huntington District issued another work order to perform Phase 3 of the inventory, which consisted of searching 24,000 acres of Forest. These search areas extended over two new watersheds, Sunday Creek and Raccoon Creek, located within the Athens District.

DATA PROCESSING AND APPLICATION DEVELOPMENT

The Forest Service's immediate objective was to identify abandoned and inactive coal mine sites and their associated features, collect required field data, then prepare a database and merge it with the existing Abandoned Mine Land database. Once all the data is compiled, the Forest Service will work with partners including the U.S. Army Corps of Engineers, Ohio Division of Mineral Resources, EPA and OSM, etc., to identify, prioritize, propose, and fund reclamation projects, which can improve aquatic ecosystems and protect human health and safety.

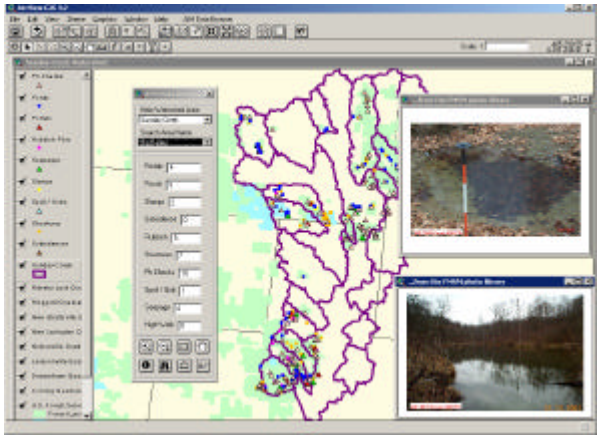
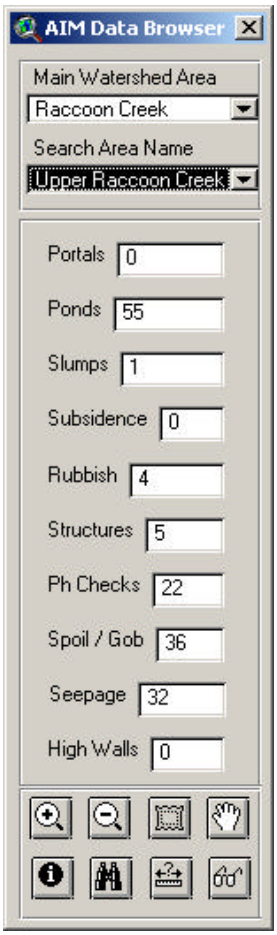


Figure 5: GIS Data Browser Application



For example, the Forest Service may need to query the database to identify certain or all open mine entries suitable for bats access, while other personnel can prioritize mine openings for closure based on their proximity to buildings, trails, or recreation areas. Or the Forest Service may decide to evaluate some or all the mine seeps, calculating chemical loadings, and making determinations of the impact each seep has to the overall water quality of the watershed. These queries may allow for the prioritization of treatment options.

Because the AIM data collected included thousands of features, with each feature characterized using several parameters, it is critical for the Forest Service to access, manage and share the voluminous database in an effective manner. Typically, the products for these inventory efforts require that contractors, such as FMSM, deliver all electronic inventory information in a standardized format and stored on CD-ROMS, which makes the management of such large database cumbersome and costly.

In order to allow the Forest Service to manage the data effectively, FMSM designed a GIS-based application specialized for user-friendly access to inventory data and maps. The Abandoned and Inactive

Mineland (AIM) Data Browser was developed as a tailored ArcView 3.x application. The application consisted of an ArcView project containing a wealth of spatial data, including: Forest Service land, locations of AIM features as identified through the inventory effort, USGS 24K topography maps, and watershed and county boundaries.

The AIM Data Browser enables non-technical users to access digital pictures, feature information, inventory statistics, and create standard map outputs using specialized templates.

Customized routines provide users flexibility for identifying AIM inventory features within sub-watersheds, querying and searching inventory attributes, viewing related digital photographs and accessing relevant statistical information.